



Vandal Hybrid Racing Project Plan for Susan V1.2 2014-15

Objectives:

The primary goal of the project is to design and build a successful hybrid racecar capable of competing in the 2015 Formula Hybrid SAE competition. The secondary goals of the project are first to design, build and test a new accumulator pack to streamline the electrical technical inspection, and improve the overall safety of the tractive system. The next major goal for the year is to reduce the overall weight of the vehicle by attacking several key areas on the vehicle, which include the accumulator pack, the suspension, wiring, and braking systems. After reducing the weight of the vehicle the next goal is to improve the reliability of several key subsystems, primarily the braking system along with the powertrain system. The team goal is to also improve the packaging of the vehicle by moving key components on the vehicle lower to the ground and closer to the center line of the vehicle. The last goal which enables the team to achieve several of the other secondary goals is to dive into research and development of several new technologies for the team. These technologies include the use of exotic materials, along with research into aerodynamics and control systems.

Expected Results:

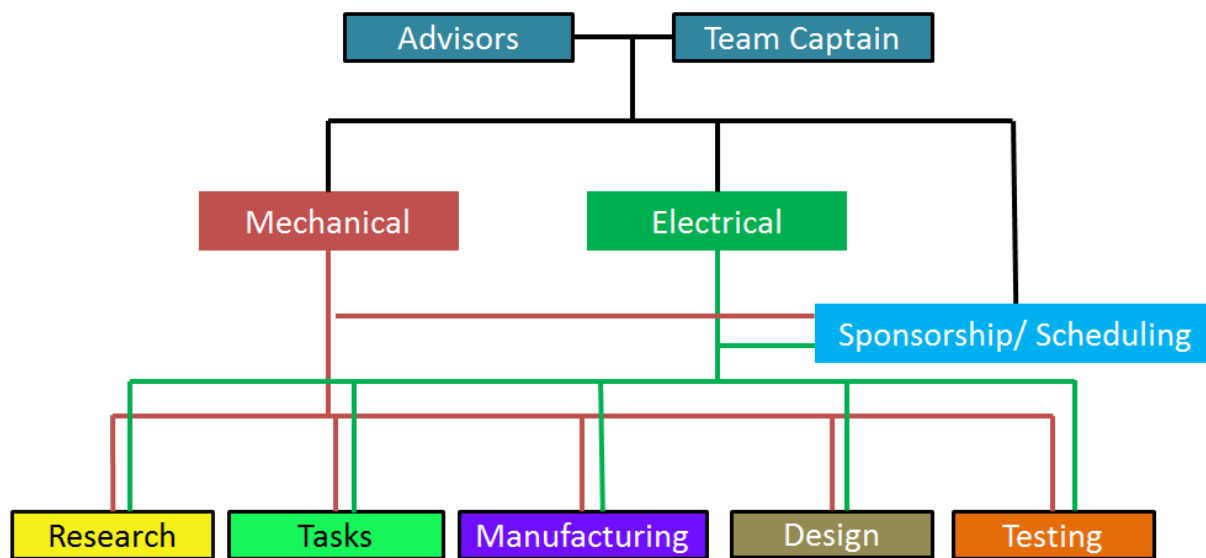
The expected results from the project are derived from the secondary goals of the project laid out in the previous section. The largest and most important result of this project is to build an accumulator pack that is rule compliant before competition, and holds a higher standard of safety than the previous design and is lighter. The project should also yield the lightest vehicle to date for the program. The team expects to remove a minimum of 20 lbs. from the overall vehicle weight but is attempting to remove 40 lbs. from the overall weight. This goal is to be achieved by the use of exotic materials and lighter designs for several sub systems, which are primarily focused on the un-sprung mass of the vehicle and the accumulator pack. The team is also looking at moving components of the vehicle lower to the ground and closer to the center line of the vehicle to improve the balance and handling characteristics of the vehicle. The movement of components also allows for a lower drag force experienced by the vehicle. To improve the reliability of the vehicle the team is looking at two key subsystems. The first subsystem needing attention is the brake systems which failed during the endurance event in the previous competition. The second system being the engines which had reliability issues with starting and consistent operation all throughout the competition. The last goal of the project is to perform research into new areas that the team has previously shied away from in the past. This research is also to help realize a few of the other goals of the project. The primary topics that are to be researched are carbon fiber, manufacturing concerns with regards to titanium, the design and use of aerodynamic devices and improved control systems. The team also seeks to test a new a method for the storage of past and current research, manufacturing techniques, engine testing methods and vehicle design analysis to be used by future teams. This storage is to allow for the passing of important design and experimentation information to improve future designs.

Team and Project Structure:

The team is organized in a hierarchical structure where the leadership is at the top of the structure and comprised of the team captain and advisors. The leadership sees to the overall direction of work, research and development for the year. The leadership brings these directives to the management level of the structure where the directive is broken up into smaller divisions such as tasks, research, manufacturing, design and testing. The directive is broken down into a manageable amount of work for one to two team members per task. This is done to maximize the limited human resources available to the team this year and minimize the amount of time require for any one task. The quick turnaround time for task set by the



management is done so that small gains can be readily achieved to improve the morale of the team which can be critical during large scale projects. When a task becomes too large or is taking too long to complete it is broken up into smaller task and distributed to other team members so that they can be quickly finished. Due to the large scale of the project and the diverse skills required to understand the tasks and work required to complete a task the team has two different managers for the project. The two managers hold equal but for the most part separate responsibilities. The managers are chosen based upon the background discipline so that a mechanically savvy manager handles the mechanical directives and an electrically competent manager handles the electrical directives. The leadership and management collectively share the responsibility to set forth the overall schedule for the project and sponsorship activities. The team has two different groups of seniors working on the project to increase the time for the design and development phase of the project totaling 14 seniors. The two groups are broken up based upon their senior design class, one group began in the summer term and ended in the fall, where the second group starts in the fall and works through the competition. The team also includes younger members who assist the seniors with tasks until they are ready for a larger responsibility and decrease the learn curve on the project if they continue on to be seniors on the team. The figure below depicts the overall structure of the team.



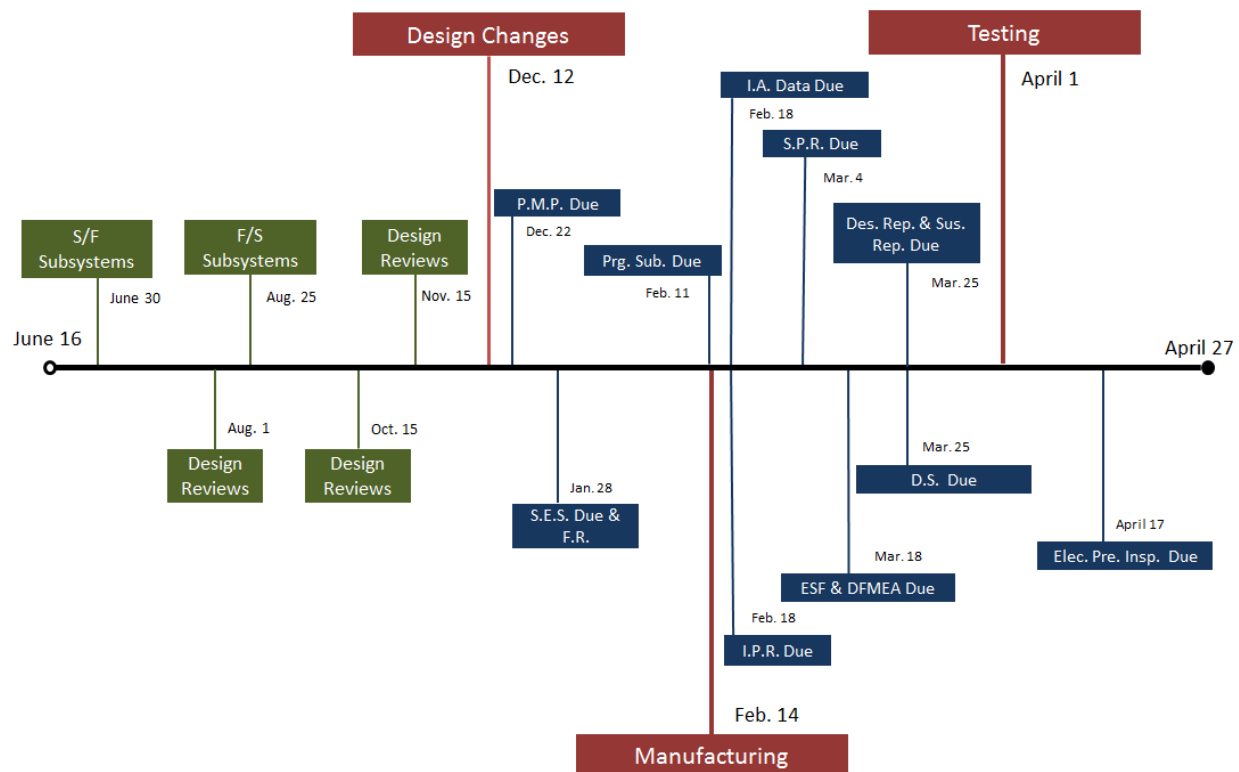
Change Management Process:

The team although structured in a hierarchical manner also allows for the reverse flow of ideas. This meaning that if an idea is brought forth that may be of benefit to the project it can be brought to one of the managers or leadership. At this point the leadership and management will collaborate on the possibility of investing time and resources into the idea and determine the best course of action to remain compliant to the timeline and goals set forth for the project. This reverse flow of ideas is also the mechanism employed by the team to allow for the dynamic change of goals for the project. When new information arises that simplifies or otherwise changes a goal of the project it is brought to the manager of the respective discipline or leadership's attention. After the leadership and management personal analyze and verify the new information the goal or goals and timeline of the project will be amended to accommodate the new change. The managers at this point will reorganize and restructure affected task groups to ensure that the project can continue smoothly. This system is used for its simplicity as well as it effectiveness, as more often than not the information that arises that changes the direction of work and research comes from the team members actually conducting the work or research.

Time Schedule:



The time schedule is critical to the success of the project. Knowing this the schedule is of the utmost importance, the leadership and management collectively structure a project timeline which is to be rigorously kept. The schedule is designed to have three major deadlines to allow enough time to compete specific tasks and research. The three deadline system is used for its simplicity and easy implementation. The system divides the project time frame into the three distinct phases for the project. The three phases are design, manufacturing and testing. The system is used as a cutoff date, such that if a task or project misses the manufacturing deadline and has a considerable amount of work still need, it will be abandoned. This action is taken to maximize the use of human resources available to the team. However if the tasks in question are critical to the success of key systems the manager will reallocate resources to expedite the completion of the task and minimize the extra time required so that the schedule will not be adversely affected. The overall time line can be seen in the figure below.



The team also employs a Gantt chart to help track and maintain specific tasks, along with the team member responsible for the task and the time taken to complete said task. The Gantt chart helps show which tasks are on schedule and where time can be recovered should a task take longer than allotted. A portion of the Gantt chart currently in use can be seen in the appendix.



Appendix

Required Items		Status	Primary	Secondary	21-Oct	28-Oct	4-Nov	11-Nov	18-Nov	25-Nov	2-Dec	9-Dec	16-Dec	23-Dec	30-Dec	6-Jan	13-Jan	20-Jan	27-Jan	3-Feb	10-Feb	17-Feb	24-Feb	3-Mar	10-Mar	17-Mar	24-Mar	31-Mar	4/17/20	
Team Suspension and Brakes																														
Upright Design	Monk	Quatermain	#####																											
Wheel Speed Sensor Design	Zane	Darren	#####																											
Upright Jig	Monk	Quatermain	#####																											
Upright manufacturing Steel	Monk	Quatermain																												
Wheel Speed Sensor manufacturing	Zane	Darren																												
Upright manufacturing Titanium	Luigi	Quatermain																												
Titanium cutters	Luigi	Teddy Bear																												
Titanium CV Joints	Luigi	Teddy Bear																												
Inboard Toe Rod Bracket Design	Darren	Quatermain	#####																											
Inboard Toe Rod Bracket Steel manufacturing	Quatermain	Monk	7-Dec																											
Inboard Toe Rod Bracket Aluminum manufacturing	Quatermain	Monk																												
Rod Assembly Redesign	Gilligan	Zane	#####																											
Rod Assembly manufacturing	Gilligan	Luigi																												
Pedal Assembly Plate	Gilligan	Zane																												
Pedal Extension Aluminum	Gilligan																													
Brake Hose Install	Gilligan		21-Oct																											
Steel Suspension manufacturing	Team Sus.	Matt																												
Carbon Fiber Tensile Test	Zane	Jon	Testing																											
Ball Joint Carriers Rear and Front Design	Zane	Darren																												
Ball Joint Carriers Rear and Front Manufacturing	Zane	Darren																												
Carbon Suspension manufacturing	Zane	Jon																												
Carbon A-Arm Covers	Teddy Bear																													
Rims for Rears	Team																													
Rover Cams	Gilligan	Zane	#####																											
Rotor Carriers	Zane	Gilligan	#####																											
Rotor Pins	Zane	Meaty	#####																											
Car Alignment	Quatermain	Monk																												
Suspension Tuning According to Driver feedback	Monk	Quatermain																												
Order Suspension Tuning equipment long lead	Meaty	Teddy Bear																												
Alignment Fixture Design	Quatermain	Monk																												
Alignment Fixture manufacturing	Quatermain	Matt																												
Team Powertrain																														
Intake Model Design	Nomio	Teddy Bear	18-Nov																											
Intake prototyping and testing	Nomio	Teddy Bear	Testing																											
Intake manufacturing	Janicki	Team																												
Dyno valve cover manufacturing	Luigi																													
Dyno Tuning	Teddy Bear	Nomio/Meaty	cold start 22-Oct, finished tuning on 15-Nov																											
Initial Race Engine	Teddy Bear	Nomio/Meaty																												
Order Starter Clutch	Teddy Bear		11-Nov																											
Spacer for Rekluze Clutch manufacturing	Teddy Bear		2-Nov																											
Radiator brackets manufacturing	Justin																													
Radiator install	Justin																													
New Scooter Shield	Meaty																													
Simulation for new motor	Jon																													
Motor mount bracket	Jon																													
Dog Clutch Design	Jon																													
R6 Exhaust Active baffling	Teddy Bear		Due before thesis																											
Ship new exhaust for ceramic coating	Teddy Bear																													
Team Electrical and Battery Design																														
Calibrate wheel speed sensor	Nomio	Zane	4-Nov																											
High Voltage Power Limit	Gordon	Troy																												
New Kelly	Meaty																													
New Motor	Jon		#####																											
New Motor Bracket Design	Jon																													
New Motor Bracket Manufacturing	Jon	Monk																												
Wiring Harness	Grant	Gordon																												
Heat Transfer Model for Battery	Jake	Ben	2-Dec																											
Battery Cell Test	Troy	Gordon	16-Nov																											
Gauge Cluster	Meaty	Grant																												
Dash	Meaty																													
Battery Box Electrical Design	Troy	Gordon																												
Battery Box Mechanical Design	Jake	Ben																												
Battery Box	Team E.																													
Team Aero and Simulation																														
Diffuser manufacturing	Janicki	Team																												
Side Pod manufacturing	Janicki	Team																												
Simulation	Gillette	Justin	18-Nov																											
CFD for various pieces	Gillette	Justin																												
Cata Model of Rear Suspension (class project)	Meaty	Jon																												
Entire Team																														
Disassemble Car	Team																													
Sand Frame	Team																													
Fix Shifting and Gear Detection	Team																													
Drivers Training	Drivers																													
New Tires	Team		Part#: 4312/81250 Tyres: 20, 56b, 0-13 R250 road racing slicks																											
Club's Staff/Office	Justin																													
Team Paper Work																														
Portfolio	Ben		will pay point due 11-Nov																											
Site Pre-Registration (register for SAE)	Teddy Bear		18-Nov																											
Sponsorship Proposal	Teddy Bear	Meaty	#####																											
Project Management (Gantt Chart)	Teddy Bear	Meaty	#####																											
Structural/Equivalency Spreadsheet (SES)	Teddy Bear	Meaty	#####																											
Program Submission	Meaty	Teddy Bear																												
Interim Project Report	Teddy Bear	Meaty																												
Impact Attenuator Data	Teddy Bear																													
ESF, FMEA	Grant	Teddy Bear																												
Design Report	Teddy Bear																													
Sustainability Report	Teddy Bear																													
Design Specification Sheet	Team																													
Electrical Pre-Inspection	Grant	Gordon/Troy																												
Sponsorship & Race																														
Custom Seats for drivers	Drivers																													
New V4r Cart	Minions	Minions																												
Long Aore Racing discounts	Meaty																													
Yamaha Racing Sponsorship	Meaty																													
Talon Racing Sponsorship																														